year at the maximum release rate. This annual population radiological dose rate corresponds to a lifetime radiological population dose of 1.1×10^{-6} rem (assuming a 70-year lifetime), which corresponds to 5.3×10^{-10} latent cancer fatality during the 70-year period of the maximum release.

The impacts were also calculated for a maximally exposed individual. Given the population data in Appendix G, Table G-48 and the joint frequency data in Table I-33, the maximally exposed individual would reside 24 kilometers (15 miles) south of the repository. An individual radiological dose factor of 5.6×10^{-14} rem per microcurie per year of release was calculated using the GENII code for this location. For a 3.3-microcurie-per-year maximum release rate, the individual maximum radiological dose rate would be 1.8×10^{-13} rem per year, corresponding to a 9.2×10^{-17} probability of a latent cancer fatality. The 70-year lifetime dose would be 1.3×10^{-11} rem, representing a 6.4×10^{-15} probability of a latent cancer fatality.

I.7.3 SCREENING ARGUMENT FOR RADON

The uranium placed in the repository would continuously produce radon as a decay product. The longest-lived radon isotope is radon-222, with a half-life of 4 days (DIRS 103178-Lide and Frederikse 1997, p. 4-24). The only potential transport and human exposure pathway for radon would be through the atmosphere because radon would not travel far enough in water to reach an individual before decaying.

A study performed by Y.S. Wu and others (DIRS 103690-Wu, Chen, and Bodvarsson 1995, all) at Lawrence Berkeley National Laboratory calculated gas and heat flow from the mountain due to steam formation and repository induced heating. This study calculated heat and mass fluxes for 57- and 114-kilowatt-per-acre emplacements. The study indicated maximum gas fluxes at the surface of about 2×10^{-7} kilogram per second per square meter at the Ghost Dance and Solitario Canyon faults and generally no more that 2×10^{-9} kilogram per second per square meter over the remainder of the surface.

The gas flux at the Ghost Dance fault was used to estimate a lower limit for the gas travel time after the waste packages began to fail. The travel times would be longer for a smaller thermal gradient and most waste packages are estimated to remain intact until long after the thermal gradient from the waste emplacement had declined to almost zero. However, this calculation still applies if a waste package failed during the period of highest thermal gradient.

A gas pore velocity, using the estimated gas flux for the Ghost Dance Fault, applicable for gas travel from the repository horizon to the surface, is calculated from the following equation:

$$Vp = Fg / (Da \times Rp)$$

where:

Fg = Gas flux (2×10^{-7} kilogram per second per meter squared)

Da = Density of air (approximately 1.2 kilogram per cubic meter at 20º Celsius) (DIRS 127163-Weast 1972, p. F-11)

Rp = Rock porosity (0.082, unitless) (DIRS 100033-Flint 1998, Table 7, p. 44)

Vp = Pore Velocity (meters per second) = 2.03×10^{-6}

Travel time from the repository horizon to the surface is calculated from the following equation:

$$T_t = Rd / (Vp \times 86400)$$

where:

Rd	=	Depth to the repository (approximately 200 meters)
86400	=	Number of seconds per day
T_t	=	Gas travel time (days) = 1,140

Because the radioactive decay constant for radon-222 is 0.18145 (per day), radioactive decay would reduce the amount of radon-222 in the air by approximately 90 orders of magnitude in the time it took the air to travel from the repository horizon up through 200 meters (660 feet) of overlying rock. Therefore, no human effects are anticipated from the atmospheric release of radon-222 in the waste packages.

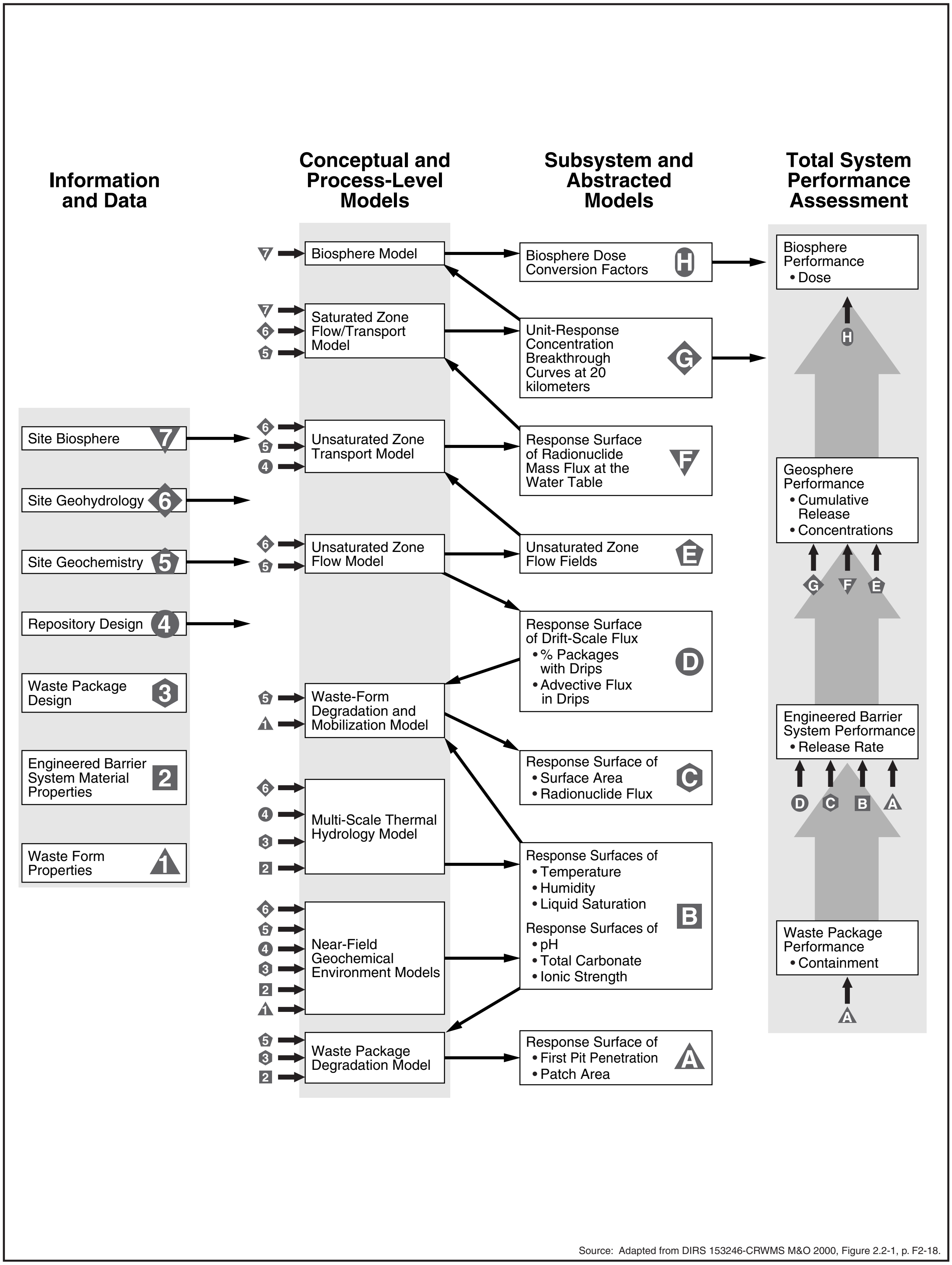


Figure I-1. TSPA model.

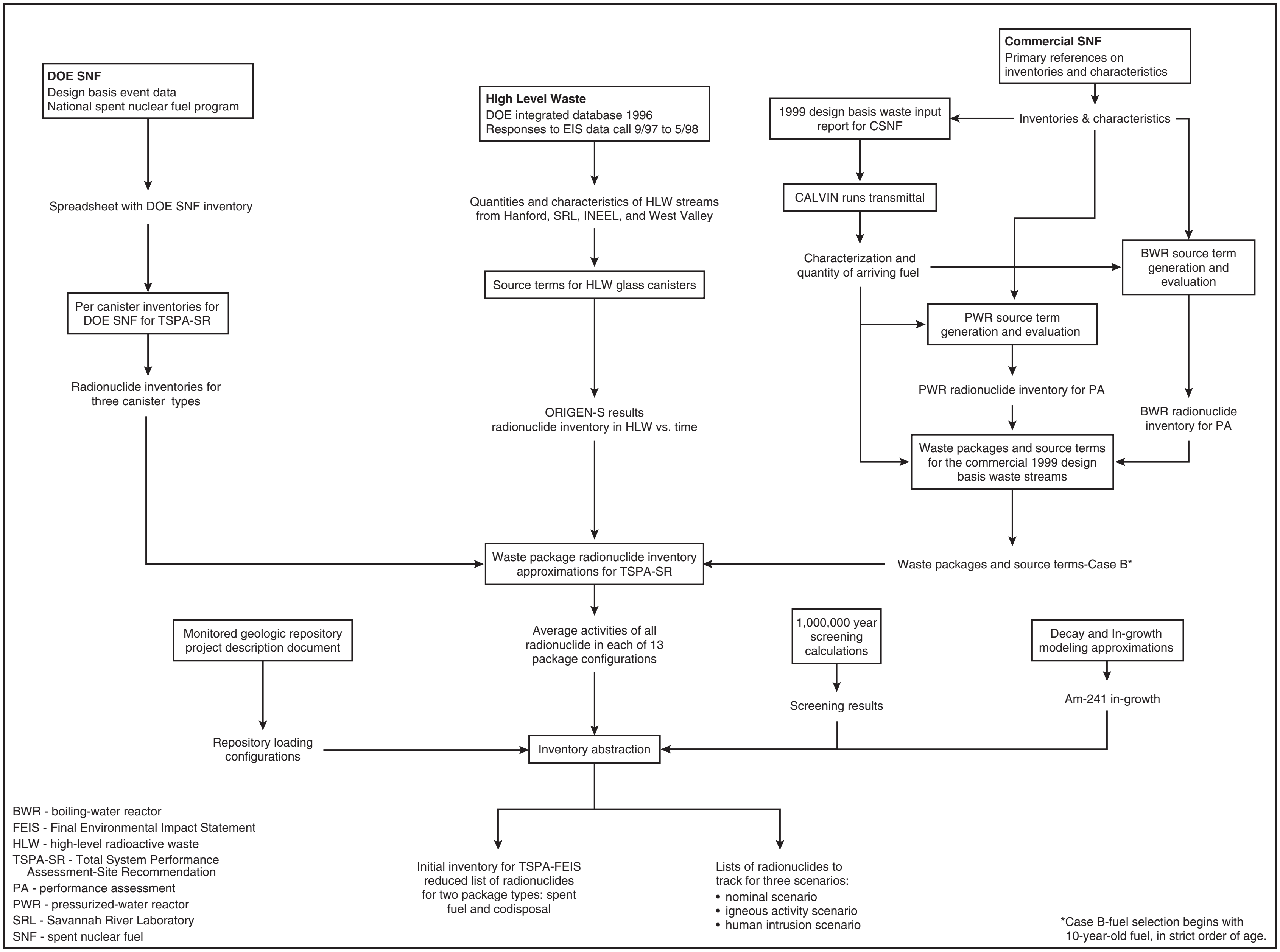


Figure I-2. Development of abstracted inventory for TSPA-FEIS.

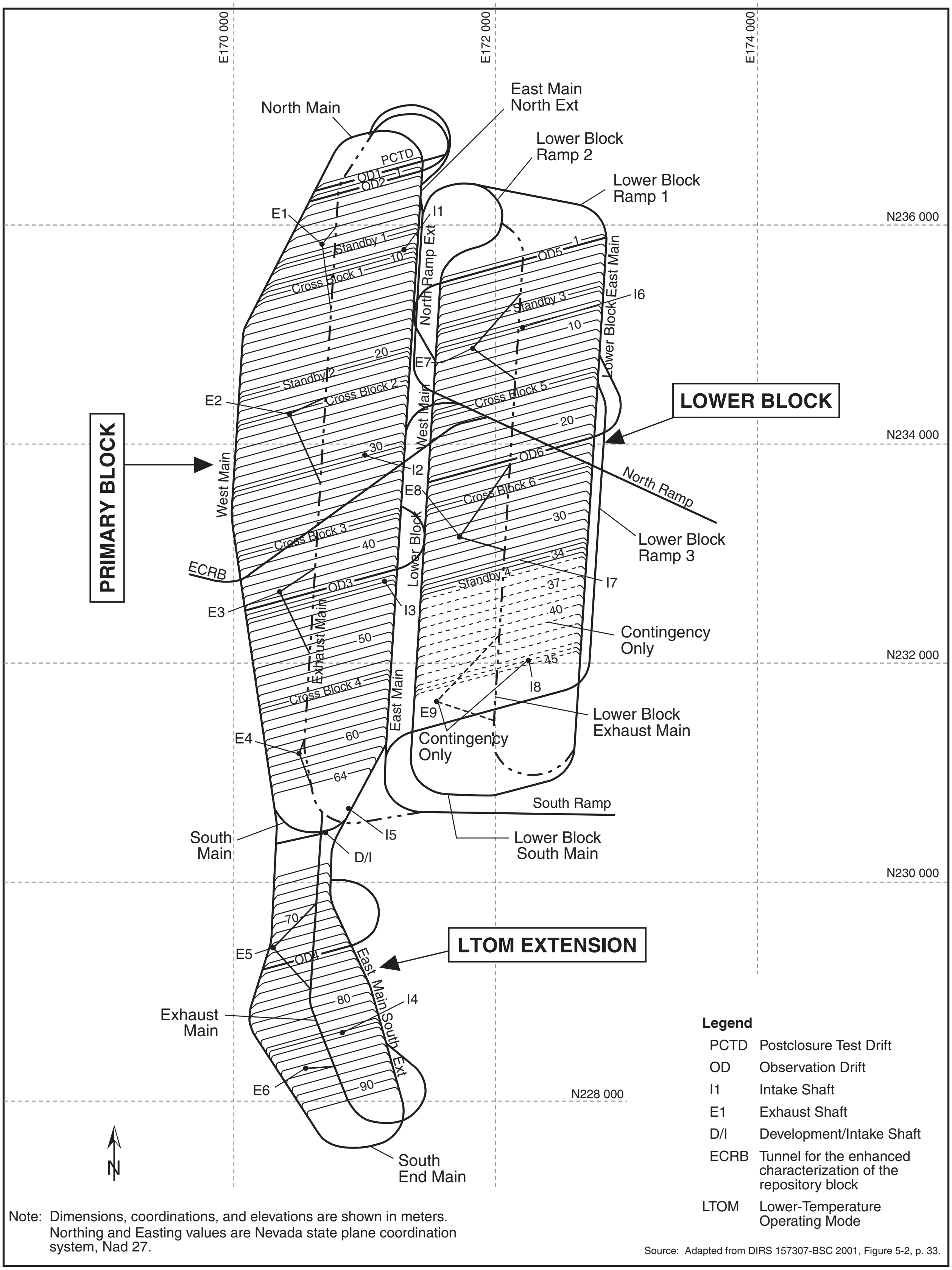
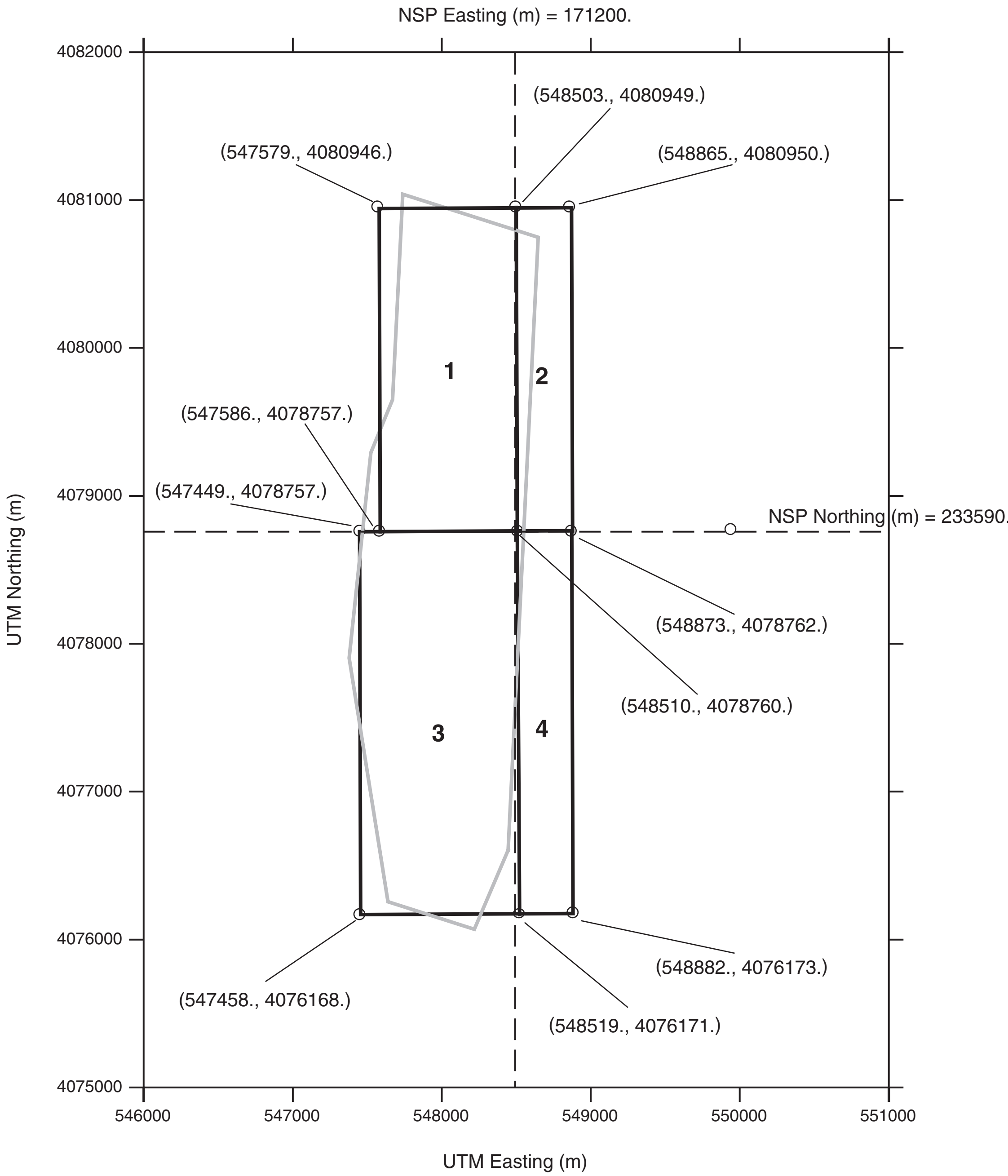


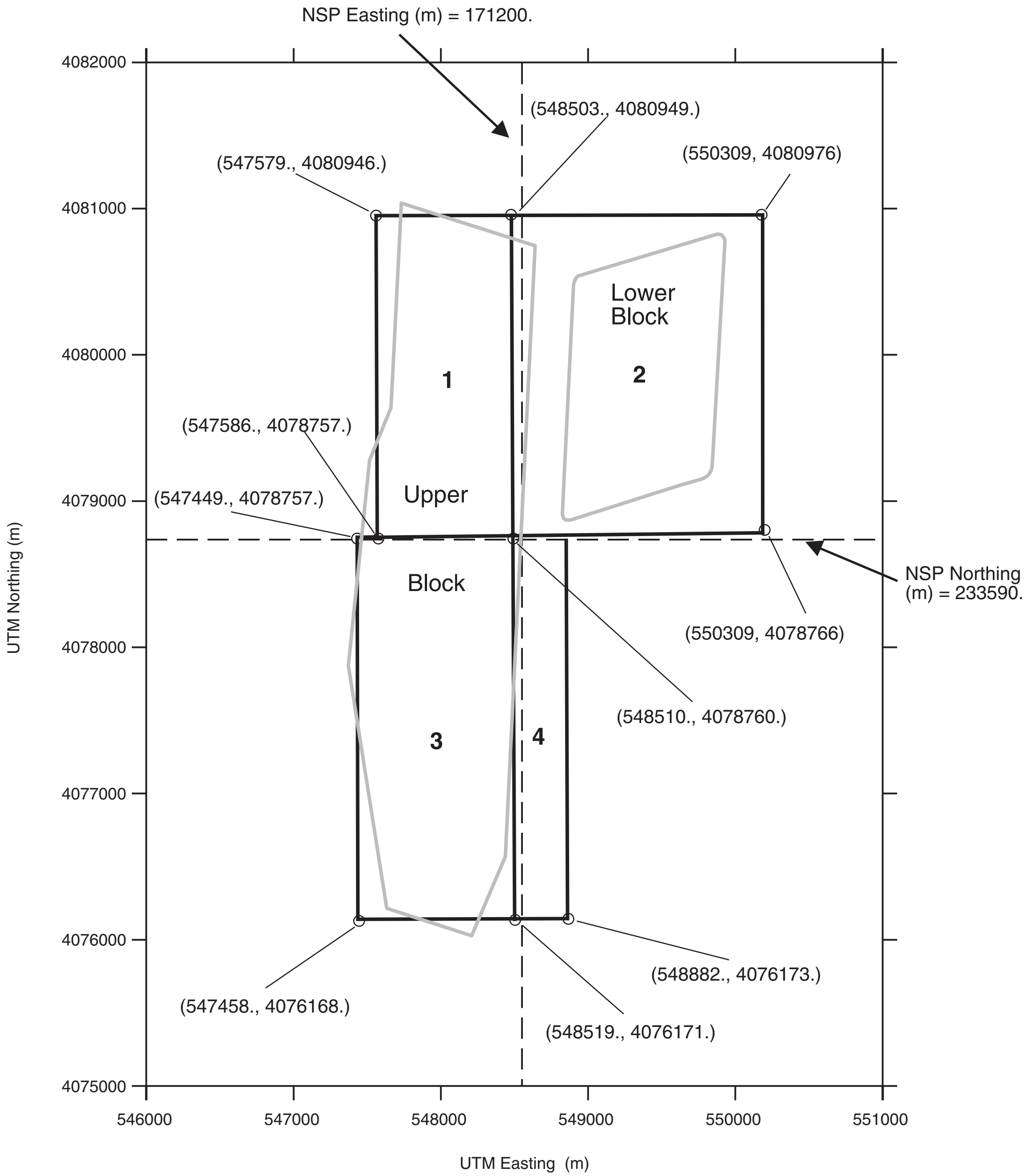
Figure I-3. Approximate configuration of the proposed Yucca Mountain Repository.



Note: Source regions are outlined with the solid black rectangles and numbered from 1 to 4. The coordinates of the vertices of the source region rectangles are given in Universal Transverse Mercator (UTM) coordinates (meters). The outline of the repository is shown by the gray lines. The dashed lines indicate the quadrants from which radionuclide arrivals from the unsaturated zone model are applied to the saturated zone source regions. Coordinates of the dashed lines are given in Nevada State Plan (NSP) coordinates (meters).

Source: Adapted from DIRS 157307-BSC 2001, Figure 5-3, p. 34.

Figure I-4. The four saturated zone capture regions in relation to the primary repository block for the Proposed Action.



Note: Source regions are outlined with the solid black rectangles and numbered from 1 to 4. The coordinates of the vertices of the source region rectangles are given in Universal Transverse Mercator (UTM) coordinates (meters). The outline of the repository is shown by the gray lines. The dashed lines indicate the quadrants from which radionuclide arrivals from the unsaturated zone model are applied to the saturated zone source regions. Coordinates of the dashed lines are given in Nevada State Plan (NSP) coordinates (meters).

Source: Adapted from DIRS 157307-BSC 2001, Figure 5-4, p. I-35.

Figure I-5. The four saturated zone capture regions in relation to the primary and lower repository blocks for Inventory Modules 1 and 2.

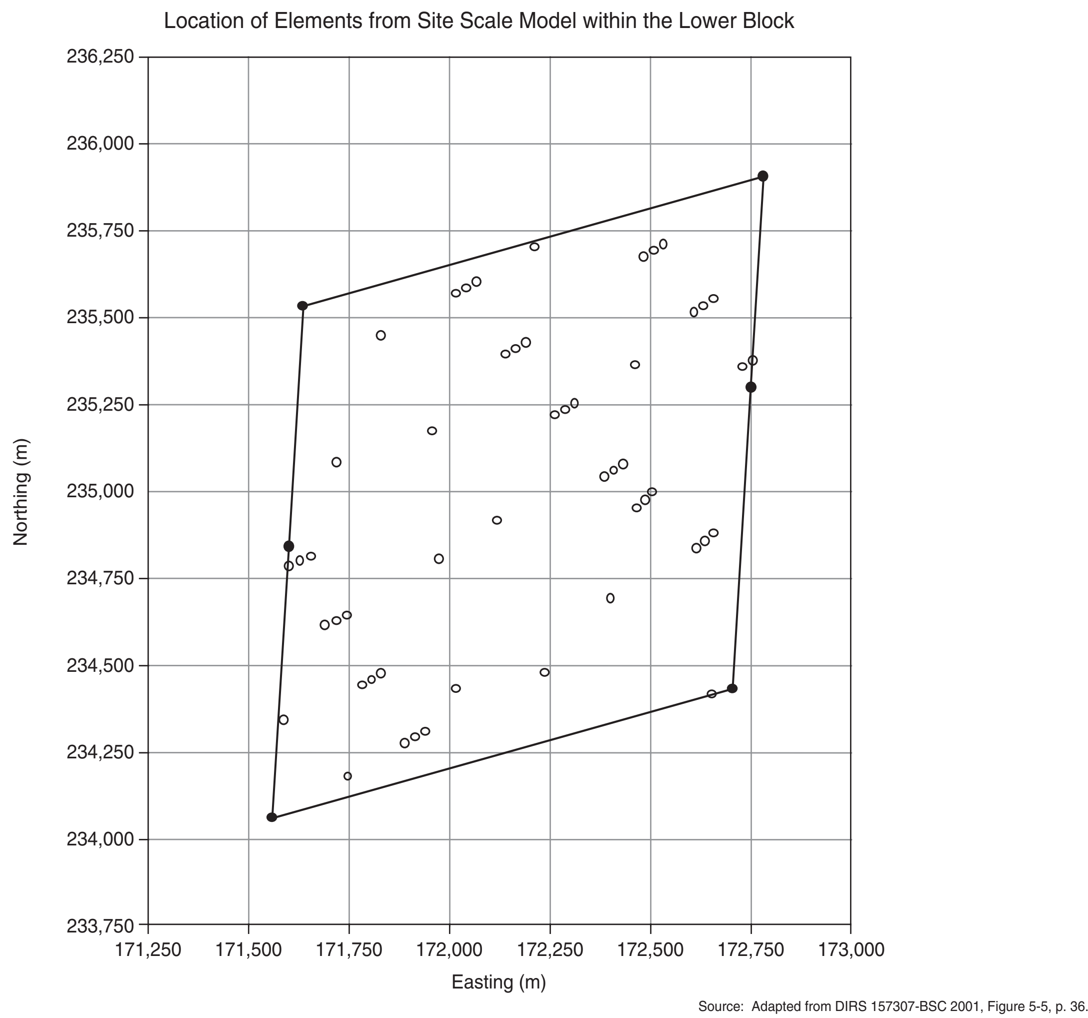
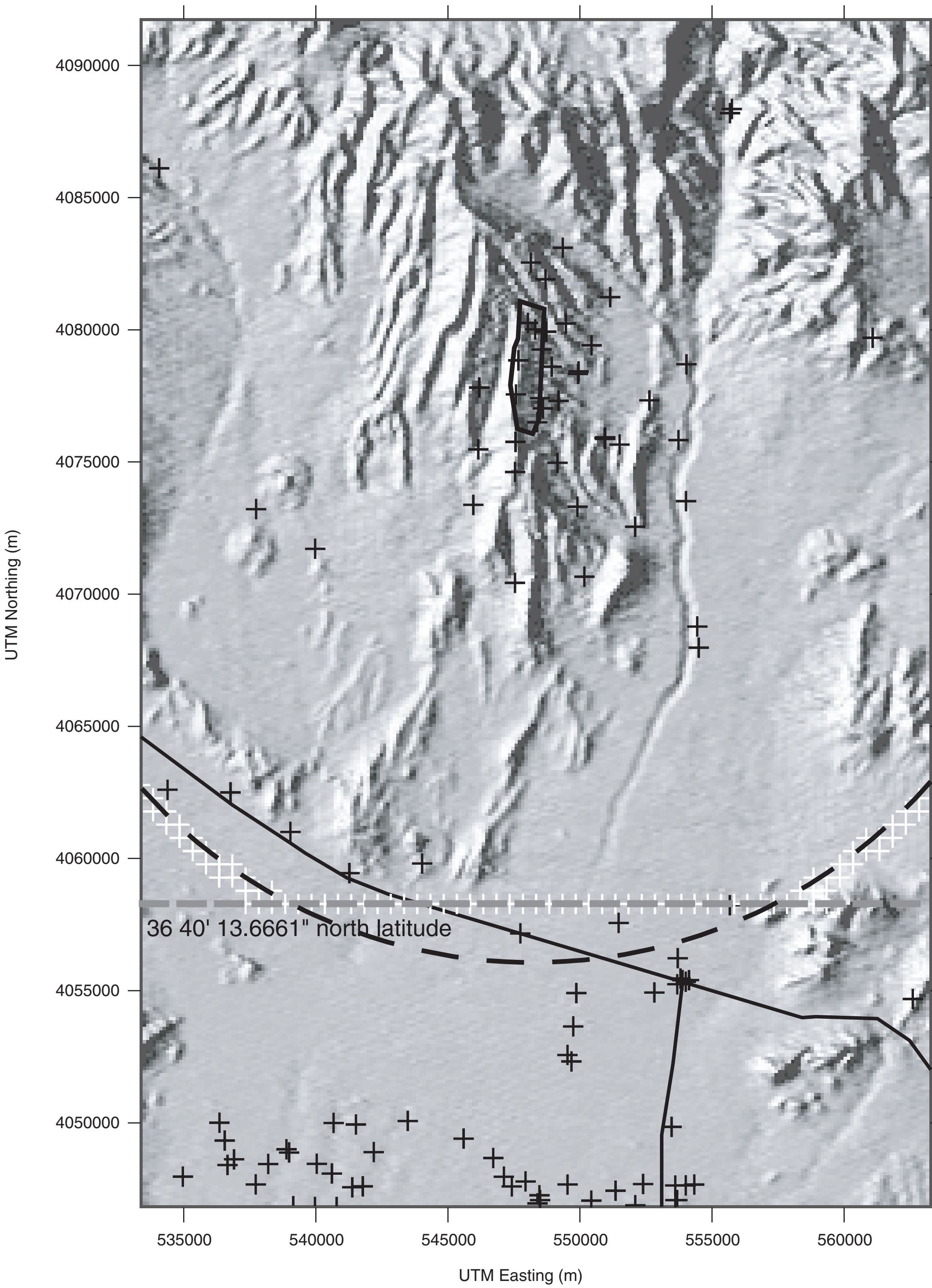


Figure I-6. Outline of the Lower Block showing the locations of the 51 particle-tracking nodes.



Note: The horizontal dashed line represents the southernmost boundary between the controlled area and accessible environment (36º 40' 13.6661" North latitude as per EPA 40 CFR Part 197). The semicircular dashed line represents the 20-kilometer (12-mile) fence used in the TSPA-SR model to evaluate compliance with the then-proposed Environmental Protection Agency and Nuclear Regulatory Commission regulations. The white crosses represent the saturated zone transport model grid cells at the intersection of the new southernmost boundary with the 20-kilometer fence used in TSPA-SR evaluations. The black crosses are well locations, and the solid black lines represent Highway 95 and Highway 373.

Source: Adapted from DIRS 157307-BSC 2001, Figure 5-6, p. 37.

Figure I-7. Southernmost boundary of the controlled area and the accessible environment.